

Endoscopic approach to maxillo-facial trauma



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AIM: This article reviews the application of endoscope-assisted techniques to the treatment of maxillofacial trauma and discusses some aspects of these techniques and reporting our experience.

INTRODUCTION: In the last decades, diagnostical imaging, surgical techniques and surgical instrument development allowed a great progress in management of facial fractures. In recent years, to some Authors, endoscopic approach to maxillofacial trauma has become common for reducing zygomatic arch, orbital blow-out, medial orbital wall, frontal sinus and subcondylar mandibular fractures. The endoscopic reduction of facial fractures as an alternative to open reduction allowed to manage patients with less unwanted complications. In fact, endoscopic approach permit to decrease perisurgical morbidity and offers to surgeons to reach good results.

DISCUSSION: Indications to endoscopic reduction are represented by dimension, extension and site of the fracture and to the surgeon's experience.

CONCLUSIONS: The use of endoscopy in maxillo-facial surgery represents one of the main realities of modern medicine together with advanced sectors of biomedical engineering research. In this way, not only time of hospitalization will be reduced but also morbidity in maxillofacial surgery.

KEY WORDS: Endoscopic approach, Maxillo-facial trauma

Introduction

In the last years the endoscopic techniques registered a further progressive implementation in complexity and numbers, whit the introduction of the endoscopic procedures in new operative fields, such as surgery. Nowadays it represents one of the main realities of mod-

ern medicine together with advanced sectors of biomedical engineering research. The use of endoscopes in maxillofacial surgery offers a new and innovative approach for the treatment of facial fractures¹. Actually, endoscopic approach to maxillofacial trauma has been reported in treatment of zygomatic arch, orbital fractures, frontal sinus fractures and subcondylar mandibular fractures, with acceptable results¹. Indications to endoscopic reduction are represented by dimension, extension and site of the fracture and to the surgeon's experience¹. Overall, this procedure makes less invasive surgery possible with limited incisions and results in reduced patient morbidity and quicker patient recovery¹⁻³. In this paper the application of endoscope-assisted techniques to the treatment of zygomatic arch, orbital, frontal sinus and subcondylar fractures is presented.

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Fractures of the floor and medial wall of the orbit

Fractures of the orbit are frequently observed in facial trauma and can cause a variety of functional problems and cosmetic deformities. Blow-out and medial wall fractures, in particular, may cause incarceration of the elements contained in the orbital cavity resulting in diplopia, enophthalmos, and visus impairment⁴.

The surgical technique through a Caldwell-Luc access and the reduction of the fracture by placing in the maxillary sinus a gauze or a balloon, was widely used in the past⁵. However, the poor control of the fracture fragments and the possible complications over the orbital contents lead this technique to be abandoned in favor of the classic external surgical accesses incisions as lower eyelid, subciliary or trans-conjunctival. Nevertheless, these surgical accesses are not free from complications such as eyelid retraction, scleral show or ectropion⁶. For this reason, some authors have proposed again the trans-antral approach associated with the reduction and fixation of fractures through the endoscope. Indeed, the use

of the endoscopic equipment allows a better assessment of fracture borders and reduces the risk of possible orbital complications⁷.

The surgical technique used in the treatment of blow-out fractures consists in an antrostomy of the anterior wall of the maxillary sinus with a Caldwell-Luc access, the exposition of the fracture, its reduction and fixation by placing a space maintainer in the maxillary sinus or biocompatible materials such as titanium nets or alloplastic^{4,8}.

Performing this technique, however, requires a relatively large endoral incision, creation of a wide stoma in the anterior wall of the maxillary sinus and a challenging learning curve as for the use of optics with an angle of 30 degrees (generally the most used). Moreover, it is difficult to reduce the herniation of the orbital contents and also it is not easy to place the implant to restore the integrity of the orbital floor.

For these reasons, endoscopic indications for the fractures of the orbital floor are limited to the treatment of those cases with diplopia caused by entrapment of the



Fig. 1: CT scan examination before and after surgery of a patient with medial and orbital floor fracture

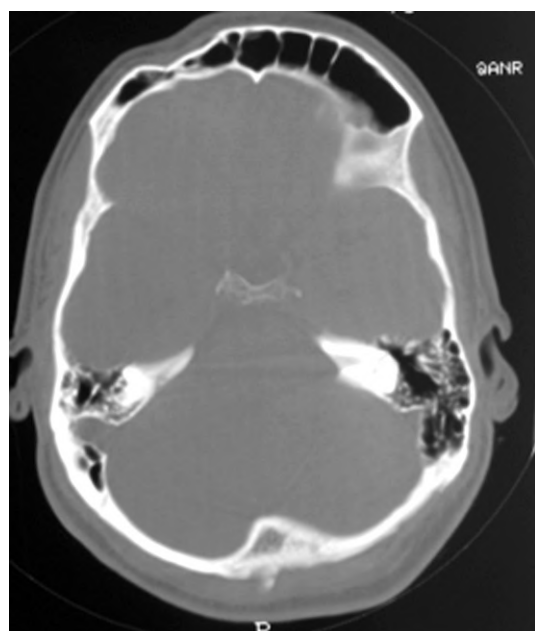


Fig. 2: Fracture of the anterior wall of the frontal sinus, pre surgery CT scan examination

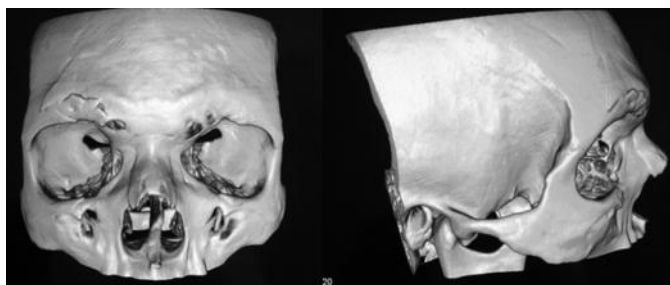


Fig. 3: 3D Ct scan of post-surgical fracture of the anterior wall of the frontal sinus

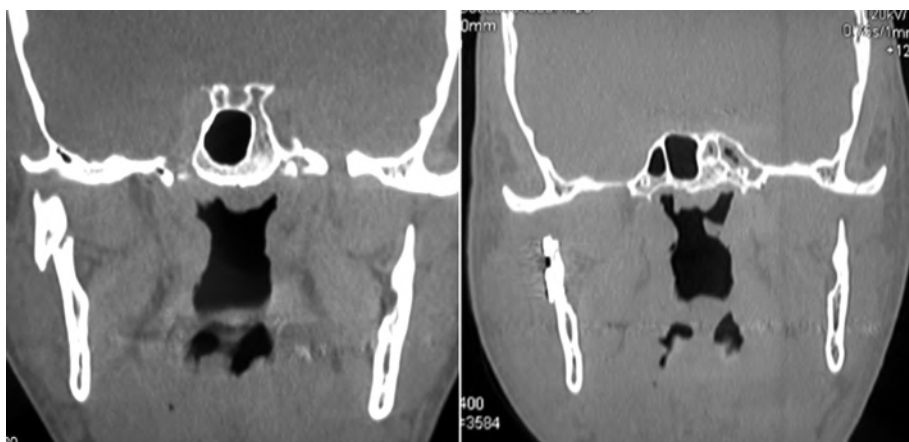


Fig. 4: CT scan Examination pre and after treatment of subcondylar fracture

peri-orbital tissue, or with very small bony defects of the floor and when it is necessary to evaluate the fractures in association to open access.

The endoscopic treatment medial orbital wall fractures consists in an intranasal access, followed by the identification of the maxillary sinus ostium, a partial ethmoidectomy to expose the bony fragments, their removal and finally the placement of biocompatible materials, quite similar to those mentioned for the fixation of the orbital floor fractures. Furthermore, in fractures of the orbital medial wall, it is difficult to control the retrobulbar region⁹.

PATIENTS

In our experience, we report a study group of 7 patients with fractures of floor and medial wall of the orbit endoscopically treated, excluding all patients with associated fractures of the zygomatic arch. Of the 7 patients in group, 2 reported a fracture of the orbital floor and 3 of the medial wall of the orbit, 1 patient reported fractures both of the medial wall and the orbital floor. They were 5 men and 2 women, aged from 22 to 74 years with a mean of 39.7 years. Clinically, 4 patients had diplopia, confirmed by orthoptic exam. All patients were subjected to CT scan examination pre and post surgery.

RESULTS

In all patients of the study group, fractures of floor and medial orbital wall were reduced, confirmed by endoscopic visualization and CT scan examination. For the 3 patients with orbital floor fracture was used sheets of dura mater, while in the 4 cases with fracture of the medial wall of the orbit was performed only in the reduction of the fractures. The 4 patients with diplopia had complete resolution. None of the patients had infections and bleeding. In follow-up, performed at one year after surgery, there was no evidence of recurrence and migration of the plate.

Fractures of the frontal sinus

Frontal sinus fractures are traditionally treated by open approach through a coronal incision that allows a wide exposure of the fracture and its subsequent reduction. This approach achieves very good results but complications are several, such as the size of the wound, the development of alopecia in the area of incision, paresthesia, and facial nerve injury¹⁰⁻¹².

Endoscopically assisted repair was considered when a clear aesthetic deformity appeared and the CT showed

only dislocation of the anterior table. The other patients who have more extensive trauma involving anterior wall, frontal recess and posterior wall, making, according to the literature, a conventional coronal approach^{13,14}.

The endoscopic approach allows to perform the treatment of fracture using only two incisions, with a technique very similar to that used in the lifting of the arch eyebrows (browlift). A parasagittal working incision of 3 to 5 cm is made above the fracture and an incision of 1 to 3 cm is made behind the hairline. A second incision of 1 to 2 cm is made 4-6 cm medially to the working incision. When present, existing lacerations were used. After careful dissection of the subperiosteal layer with an optical dissector a 4 mm, 30° endoscope was introduced. Dissection over the fracture is performed under direct vision to the level of the orbital rims. The fracture was repositioned using small elevators and hooks to reduce depressed segments, occasionally using a small burr or screw for additional grip¹⁵.

PATIENTS

We report the cases of two patients with a displaced fracture of the anterior table of the frontal sinus occurred after a sports injury. The patients were both male, Caucasian, with an age of 26 and 24 years old. Clinically they showed a depression in the forehead contour and neither of the two patients had mucocele. The presence of fractures was confirmed by CT scan that it also allowed to identify the frontonasal ducts, which were not traversed by the line of fracture. The two patients underwent both to endoscopic treatment and carried out a CT scan control two days and one year after surgery. For both patients was not used any contention system but only the repositioning of the bone stumps.

RESULTS

In both patients, the fractures were reduced, confirmed by endoscopic visualization and the post-surgery CT scan examination. The two patients had complete resolution of the depression in the forehead contour obtaining a good eurythmy of the face. None of the patients had infections and bleeding. In follow-up, performed at one year after surgery, there was no evidence of recurrence.

Subcondylar fractures of the mandible

Represent an absolute indication to reduce through open access the dislocation in the middle cranial fossa and in the external ear canal, the dislocation of the joint, the inability to obtain an adequate occlusion and the presence of a open wound of the joint, with presence of foreign body and/or infection¹⁶. The evolution of endoscopic surgery technologies and techniques allowed, in recent years, a direct approach to fracture, through limited incisions¹⁷⁻¹⁹.

Two techniques were developed for the treatment of sub-

condylar fractures. One technique, used by us, consists in performing an intraoral incision and a dissection along the mandibular ramus to allow the placement of the endoscope. The second technique consists in performing a cutaneous incision close to the inferior border of the mandibular angle as a mini-Risdon approach. The first technique completely avoids external scars, unless a small transcutaneous incision is needed for the introduction of the trocars. The second technique (Risdon approach) has become less popular for the endoscopic treatment but has gained popularity as an approach for elective endoscopic mandibular orthognathic procedures. The intraoral technique requires either the use of trocars for drilling holes and the placement of screws for plate fixation, or it requires the use of right-angled drills and screw drivers that could be inserted through the intraoral incision²⁰.

The advantages of this technique compared to open access surgery are obvious: reduced risk of facial nerve injury, lower morbidity, faster postoperative recovery, reduced risk of ischemic avascular necrosis of the condyle, no visible scars. To date, the disadvantages seem to be mainly related to: prolonged surgery times, high costs of equipment, technical difficulties and need for an adequate learning curve method.

The development and testing of a new osteosynthesis device to stabilize the fixation of a subcondylar fracture, as discussed by Meyer, may represent a further stimulus to the use of endoscopy in the reduction of such fractures²¹.

PATIENTS

We report the cases of 8 patients endoscopically treated with subcondylar displaced fracture of the mandible. The patients were 5 males and 3 females, aged between 34 and 61 years old at an average of 46,4 years. In 6 of the 8 patients the fracture was unilateral in 2 patients the fracture was bilateral. In the patient with bilateral fracture, both condyles were displaced medially out of the respectively glenoid fossa, and clinically could be observed a precontact of the posterior with anterior open bite. In the 6 patients with unilateral fracture were clinically evident malocclusion, facial asymmetry and a cross bite and a limitation in mouth opening. All patients in the test group were carried out CT scans before surgery and after surgery, two days later and a year later.

RESULTS

In all patients, the fractures were reduced, confirmed by endoscopic visualization and the post-surgery CT scan examination. In the two patients with bilateral fracture the condyles were repositioned in the respectively glenoid fossae restoring a proper occlusion and obtaining a good eurythmy of the face. In the six patients with unilateral fracture, the reduction of subcondylar fractures, restored a good occlusion and solved the cross bite obtaining a good symmetry of the face. None of the

patients had infections and bleeding. In follow-up, performed at one year after surgery, there was no evidence of recurrence and migration of the plate.

Zygomatic arch

The reliable form and strategic position of the zygomatic arch make it a valuable landmark in midfacial trauma management. Repair of the arch using the traditional coronal approach is not without drawbacks. The most frequent was scar alopecia, scalp dysesthesia, significant blood loss and injuries of the frontal branch of the facial nerve. Endoscope-assisted zygomatic arch realignment and fixation allow anatomic repair without sustaining the drawbacks of extensive access incisions²². Endoscopic repair of the zygomatic arch requires small, innocuous scalp incisions. An optical cavity is created between the superficial and deep temporal fascia using a periosteal elevator. This dissection permits to preserve injury to the facial nerve. Dissection ends at level of the superior orbital rim. The endoscope is introduced and dissection continues to the zygomatic arch. The periosteum of the arch is incised and the arch repaired. Goals of zygomatic arch repair include restoration of its preinjury shape and stability. Endoscopic assistance is indicated in complex zygoma fractures, LeFort III level injuries, and in isolated arch fractures of patients with prominent contralateral arch contours, as discussed by Lee²³.

At present we have no experience in the reduction of these fractures by endoscopic approach.

Conclusions

The use of endoscopy in maxillo-facial surgery represents one of the main realities of modern medicine together with advanced sectors of biomedical engineering research. The application of endoscopy in maxillo-facial trauma is an interesting field of study as it is obtaining good surgical results using lesser invasive approaches than the classical techniques performed so far. In this way, not only time of hospitalization will be reduced but also morbidity in maxillofacial surgery. As our series is small, we believe that the endoscopic approach medial wall and orbital floor fractures, frontal sinus fractures and subcondylar fractures has advantages over the traditional approach, reducing the time of hospitalization, morbidity, and ensuring a more aesthetic result for the patient.

Riassunto

Negli ultimi 10 anni, lo sviluppo della diagnostica per immagini, delle tecniche chirurgiche e dello strumen-

tario ha consentito un grande progresso nella gestione delle fratture facciali. L'approccio endoscopico per i traumi maxillo-facciali è divenuta pratica di uso comune per la riduzione delle fratture dell'arco zigomatico, del pavimento e della parete mediale dell'orbita, del seno frontale e per delle fratture subcondilari di mandibola. L'utilizzo di un approccio endoscopico in alternativa alla tecnica open, nella riduzione delle fratture facciali ha permesso una gestione del paziente che riportava minore complicità. Infatti, l'approccio endoscopico ha permesso di diminuire la morbilità post-operatoria offrendo allo stesso tempo il raggiungimento di un buon risultato.

Le indicazioni alla riduzione endoscopica sono rappresentate dalla dimensione, l'estensione e la localizzazione della frattura nonché dall'esperienza dell'operatore. Quest'articolo esamina l'utilizzo della tecnica endoscopica-assistita per il trattamento dei traumi maxillo-facciali discutendone alcuni aspetti.

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